CLAIMS

1. A method of forming a package and sealing a MEMS device in the package comprising the steps of:

providing a supporting substrate with a surface;

forming at least one contact for the MEMS device on the surface of the supporting substrate and providing an external connection to the contact;

forming a cantilever on the surface of the supporting substrate, the cantilever being positioned to come into electrical engagement with the contact in one orientation;

depositing a seal ring on the surface of the supporting substrate circumferentially around the contact and the cantilever;

forming a cap member with a cavity and a continuous edge circumferentially around the cavity, the cavity being designed to receive the cantilever and contact therein;

depositing a seal ring on the continuous edge of the cap member; and

sealingly engaging the seal ring on the continuous edge of the cap member to the seal ring on the surface of the supporting substrate.

2. A method as claimed in claim 1 wherein the step of forming at least one contact includes forming at least one via through the supporting substrate and distributing conductive material through the via.

3. A method as claimed in claim 1 wherein the step of providing the external connection to the contact includes plating a metal on a lower end of the via, the metal being selected for solderability and formed for package clearance.

4. A method as claimed in claim 1 wherein the step of providing the supporting substrate includes providing a supporting substrate of one of GaAs, glass, silicon, quartz, ceramic, organic material, and magnetic material.

5. A method as claimed in claim 1 wherein the step of forming the cap member includes forming a cap member of one of GaAs, glass, silicon, quartz, ceramic, organic material, and magnetic material.

6. A method as claimed in claim 5 wherein the step of forming the cap member includes forming a cap member of silicon and forming the cavity by anisotropically etching the silicon.

7. A method as claimed in claim 1 wherein the steps of depositing the seal rings on the surface of the supporting substrate and on the continuous edge of the cap member each include depositing an adhesion portion and a sealing portion.

8. A method as claimed in claim 7 wherein the step of depositing the adhesion portion includes depositing one of tungsten, titanium, and combinations thereof.

9. A method as claimed in claim 7 wherein the step of depositing the sealing portion includes depositing one of nickel, gold, chrome, and alloys thereof.

10. A method as claimed in claim 1 wherein the step of sealingly engaging the seal ring on the continuous edge of the cap member to the seal ring on the surface of the supporting substrate includes a step of affixing a solder alloy to one of the seal ring on the continuous edge of the cap member and the seal ring on the surface of the supporting substrate.

11. A method as claimed in claim 10 wherein the step of affixing a solder alloy includes affixing a solder alloy of 80/20 Au/Sn.

12. A method as claimed in claim 10 wherein the step of sealingly engaging further includes the step of reflowing the solder alloy without the use of flux.

13. A method as claimed in claim 10 wherein the step of sealingly engaging further includes the step of hermetically sealing the package by reflowing the solder alloy in an inert environment without the use of flux.

14. A method as claimed in claim 1 including in addition a step of attaching a magnet to the cap member.

15. A method as claimed in claim 1 including in addition a step of attaching a permalloy member to the supporting substrate.

16. A method of forming a package and hermetically sealing a MEMS device in the package comprising the steps of:

providing a supporting GaAs substrate with a surface;

forming at least one contact for the MEMS device on the surface of the supporting substrate and providing an external connection to the contact;

forming a cantilever on the surface of the supporting substrate, the cantilever being positioned to come into electrical engagement with the contact in one orientation;

depositing a metal seal ring on the surface of the supporting substrate circumferentially around the contact and the cantilever, the seal ring including an adhesion portion and a sealing portion;

etching a cavity in a silicon chip to form a cap member with a continuous edge circumferentially around the cavity, the cavity being designed to receive the cantilever and contact therein;

depositing a metal seal ring on the continuous edge of the cap member, the metal seal ring including an adhesion portion and a sealing portion;

affixing a solder alloy to one of the metal seal ring on the continuous edge of the cap member and the metal seal ring on the surface of the supporting substrate; and

positioning the metal seal ring on the continuous edge of the cap member adjacent to the metal seal ring on the surface of the supporting substrate with the solder alloy sandwiched therebetween and hermetically sealing the package by reflowing the solder alloy in an inert environment without the use of flux.

17. A sealed package including a MEMS device comprising:

a supporting substrate with a surface;

at least one contact for the MEMS device on the surface of the supporting substrate with an external connection to the contact and a cantilever on the surface of the supporting substrate, the cantilever being positioned to come into electrical engagement with the contact in one orientation;

a metal seal ring fixed on the surface of the supporting substrate circumferentially around the contact and the cantilever;

a cap member with a cavity and a continuous edge circumferentially around the cavity, the cavity being designed to receive the cantilever and contact therein with the continuous edge in mating engagement with the metal seal ring on the surface of the supporting substrate;

a metal seal ring fixed on the continuous edge of the cap member; and

the metal seal ring on the continuous edge of the cap member sealingly engaged with the metal seal ring on the surface of the supporting substrate.

18. A sealed package as claimed in claim 17 wherein the supporting substrate and the cap member each include one of GaAs, glass, silicon, quartz, ceramic, organic material, and magnetic material.

19. A sealed package as claimed in claim 17 wherein the metal seal rings on the surface of the supporting substrate and on the continuous edge of the cap member each include an adhesion portion and a sealing portion.

20. A sealed package as claimed in claim 19 wherein the adhesion portion includes one of tungsten, titanium, and combinations thereof.

21. A sealed package as claimed in claim 19 wherein the sealing portion includes one of nickel, gold, chrome, and alloys thereof.

22. A sealed package as claimed in claim 17 wherein the metal seal ring on the continuous edge of the cap member is sealingly engaged with the metal seal ring on the surface of the supporting substrate by a solder alloy.

23. A sealed package as claimed in claim 22 wherein the solder alloy includes a solder alloy of 80/20 Au/Sn.

24. A package with a MEMS device hermetically sealed in the package comprising:

a supporting GaAs substrate with a surface;

at least one contact for the MEMS device on the surface of the supporting substrate with an external connection to the contact;

a cantilever on the surface of the supporting substrate, the cantilever being positioned to move into electrical engagement with the contact in one orientation;

a metal seal ring fixed on the surface of the supporting substrate circumferentially around the contact and the cantilever, the seal ring including an adhesion portion and a sealing portion;

a silicon chip forming a cap member and defining a cavity with a continuous edge circumferentially around the cavity, the cavity being designed to receive the cantilever and contact therein;

a metal seal ring fixed on the continuous edge of the cap member, the metal seal ring including an adhesion portion and a sealing portion;

a magnet affixed to the cap member; and

a solder alloy sealingly engaging the metal seal ring on the continuous edge of the cap member to the metal seal ring on the surface of the supporting substrate.

25. A package as claimed in claim 24 wherein the package is hermetically sealed by reflowing the solder alloy in an inert environment without the use of flux.